

# MOTOROLA SEMICONDUCTOR TECHNICAL DATA

Motorola's semiconductor products are designed to support the needs of the industrial market. A broad spectrum of semiconductor products are available to support the needs of industrial applications. Motorola offers a wide range of products to support the needs of industrial applications. Motorola offers a wide range of products to support the needs of industrial applications. Motorola offers a wide range of products to support the needs of industrial applications.

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## LonWORKS™

### Products

### Selector Guide



**MOTOROLA**

# LONWORKS TECHNOLOGY OVERVIEW AND ARCHITECTURE

LONWORKS technology is a complete platform for implementing distributed control networked systems. These systems consist of intelligent devices or *nodes* that interact with their environment, and communicate with one another over a variety of communications *media* using a common, message-based control *protocol*.

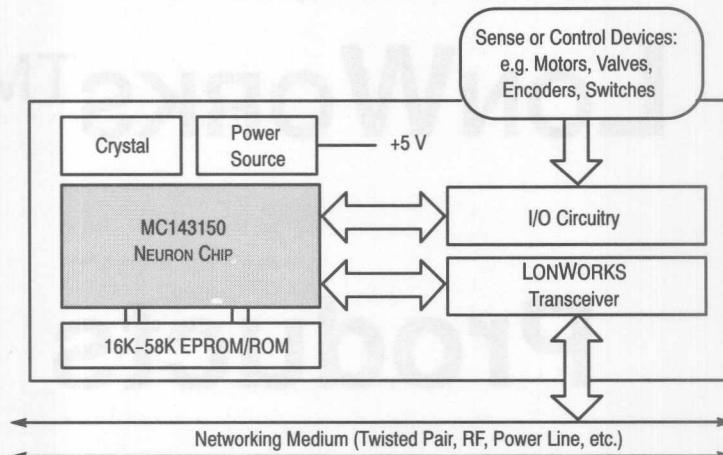
LONWORKS technology includes all of the elements required to design, deploy and support control networks, specifically the following components:

- MC143150 and MC143120 NEURON CHIPS
- LONTALK Protocol
- LONWORKS Transceivers
- LONBUILDER Developer's Workbench

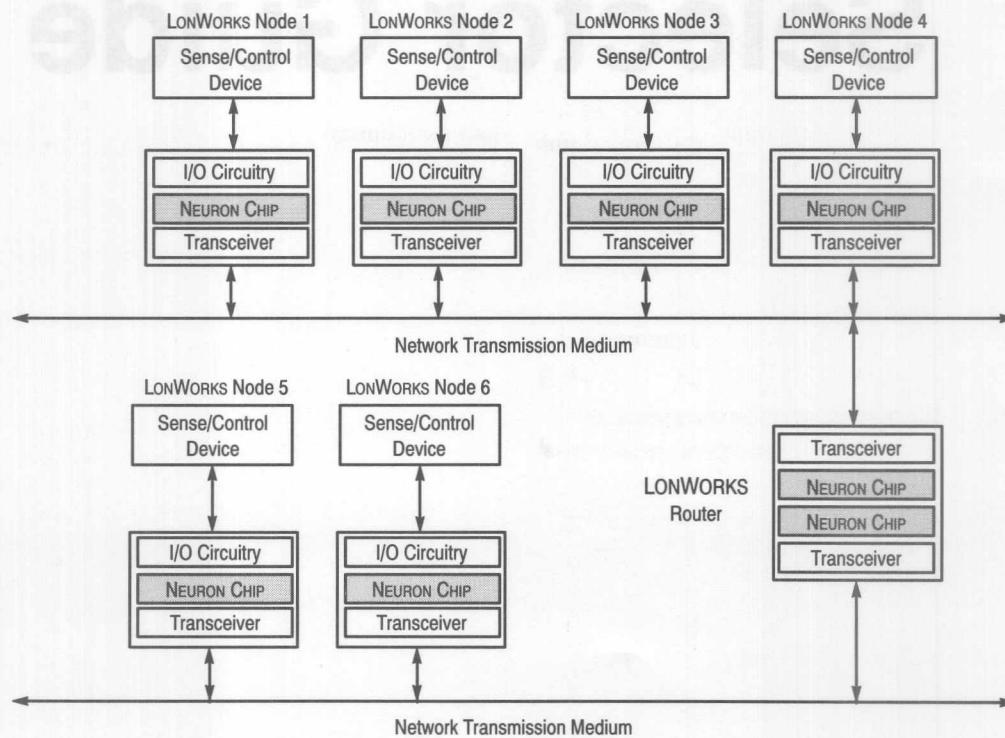
The Motorola NEURON CHIP is a VLSI component that performs the network and application-specific processing within a node. A node typically consists of a NEURON CHIP, a power source, a transceiver for communicating over the network medium, and circuitry for interfacing to the device being controlled or monitored. The specific circuitry will depend on the networking medium and application.

LONWORKS technology can support a variety of network data rates up to and including 1.25 MPBS on twisted pair (using direct drive, EIA-485 or transformer coupled interfaces). Other media such as powerlines, RF, infrared, fiber-optics, and ultrasonics can be used with an appropriate transceiver.

**MC143150 in a Typical Node Block Diagram**



**The MC143150 or MC143120 in a LONWORKS Network**



# NEURON CHIPS

The Motorola MC143150 and MC143120 NEURON CHIPS are sophisticated VLSI devices that make it possible to implement low-cost local operating network applications. Through a unique combination of hardware and firmware, they provide all the key functions necessary to process inputs from sensors and control devices intelligently, and propagate control information across a variety of network media. The MC143150 and MC143120 with the LONBUILDER Developer's Workbench offer the system designer:

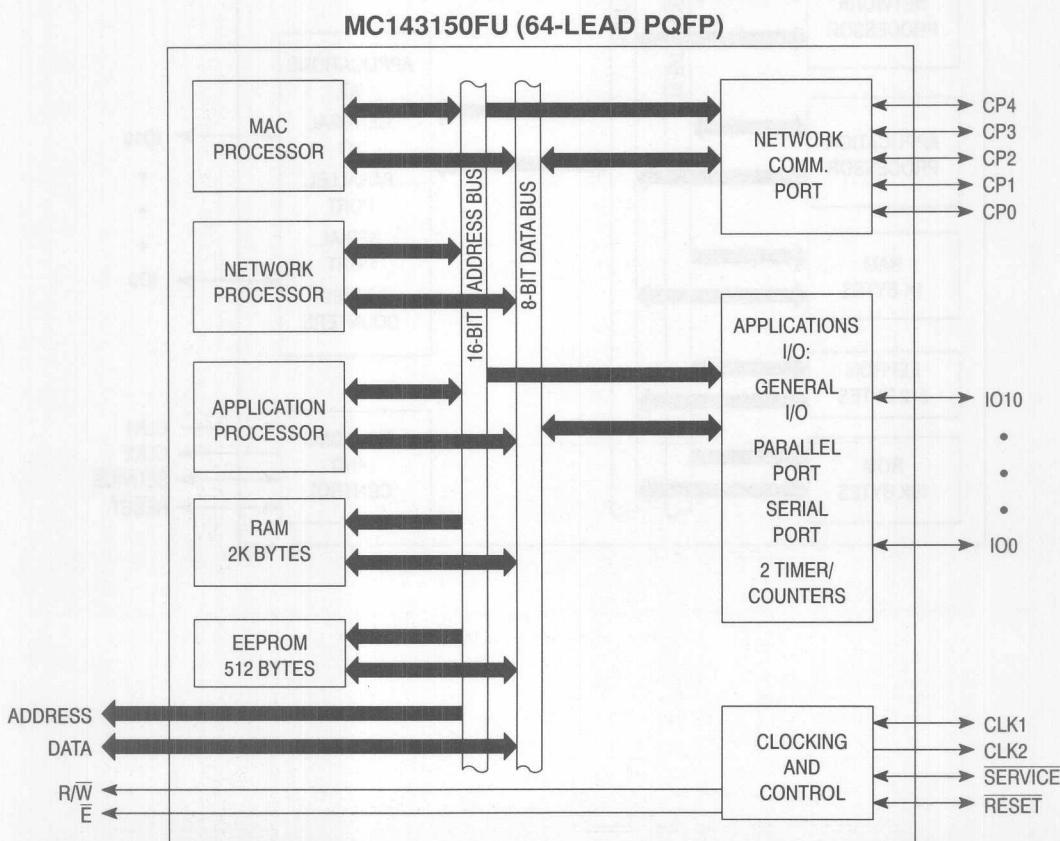
- Easy implementation of distributed sense and control networks
- Flexible reconfiguration capability after network installation
- Management of LONTALK protocol messages on the network
- An object-oriented high level environment for system development

Applications include:

- Distributed sense and control systems
- Instrumentation
- Machine automation
- Process control
- Diagnostic equipment

- Environmental monitoring and control
- Power distribution and control
- Production control
- Lighting control
- Building automation and control
- Security systems
- Data collection/acquisition
- Robotics
- Home automation
- Consumer electronics
- Automotive electronics

The MC143150 is designed for sense and control systems that require large application programs. An external memory interface allows the system designer to use 42K of the available 64K of address space for application program storage. The MC143150 has no ROM on the chip. The communications protocol, operating system, and 24 I/O function object code is supplied with the LONBUILDER starter kit (MC143160EVK). The protocol and application code can be located in external ROM, EEPROM, NVRAM, or battery-backup static RAM.



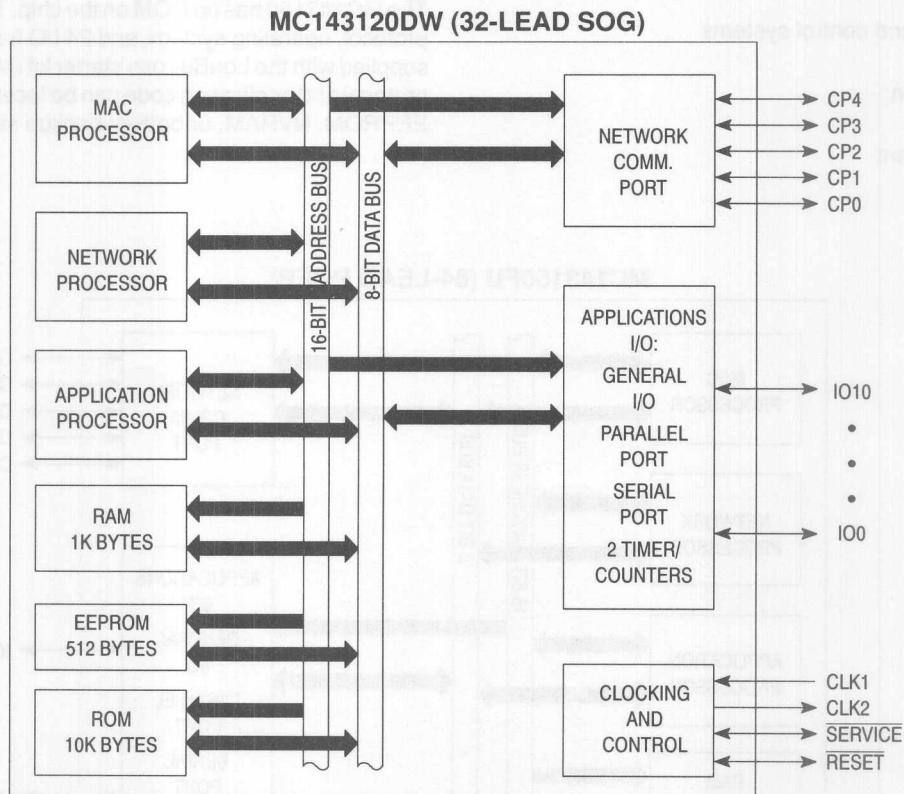
## NEURON CHIPS (continued)

The MC143120 has no external memory interface, and is designed for nodes that require smaller application programs. It contains 10K of mask ROM that implements the communications protocol, operating system, and the 24 I/O functions that can be accessed by the application program. The application program resides in the internal 512 bytes of EEPROM, and utilizes the firmware in the masked ROM for the specific application.

Both parts have an eleven pin I/O interface with integrated hardware and software for connecting to motors, valves, display drivers, A/D converters, pressure sensors, thermistors, switches, relays, triacs, tachometers, other microprocessors, modems, etc. They each have three processors, of which two interact with a communication

subsystem to make the transfer of information from node to node in a distributed control system an automatic process.

The complete communication protocol firmware, which is provided, implements optional services at all seven layers of the OSI model. These include multicast addressing, automatic acknowledgements of messages sent, foreign-frame transmission, authentication, duplicate detection, and many others. A predictive Collision Sense Media Access (CSMA) system using a patented collision avoidance algorithm maximizes bandwidth utilization under high network loading conditions. A five-lead communications port supports interfacing to network transceivers that include EIA-485 drivers, RF modulators, powerline modems, ultrasonic and fiber-optic transceivers.

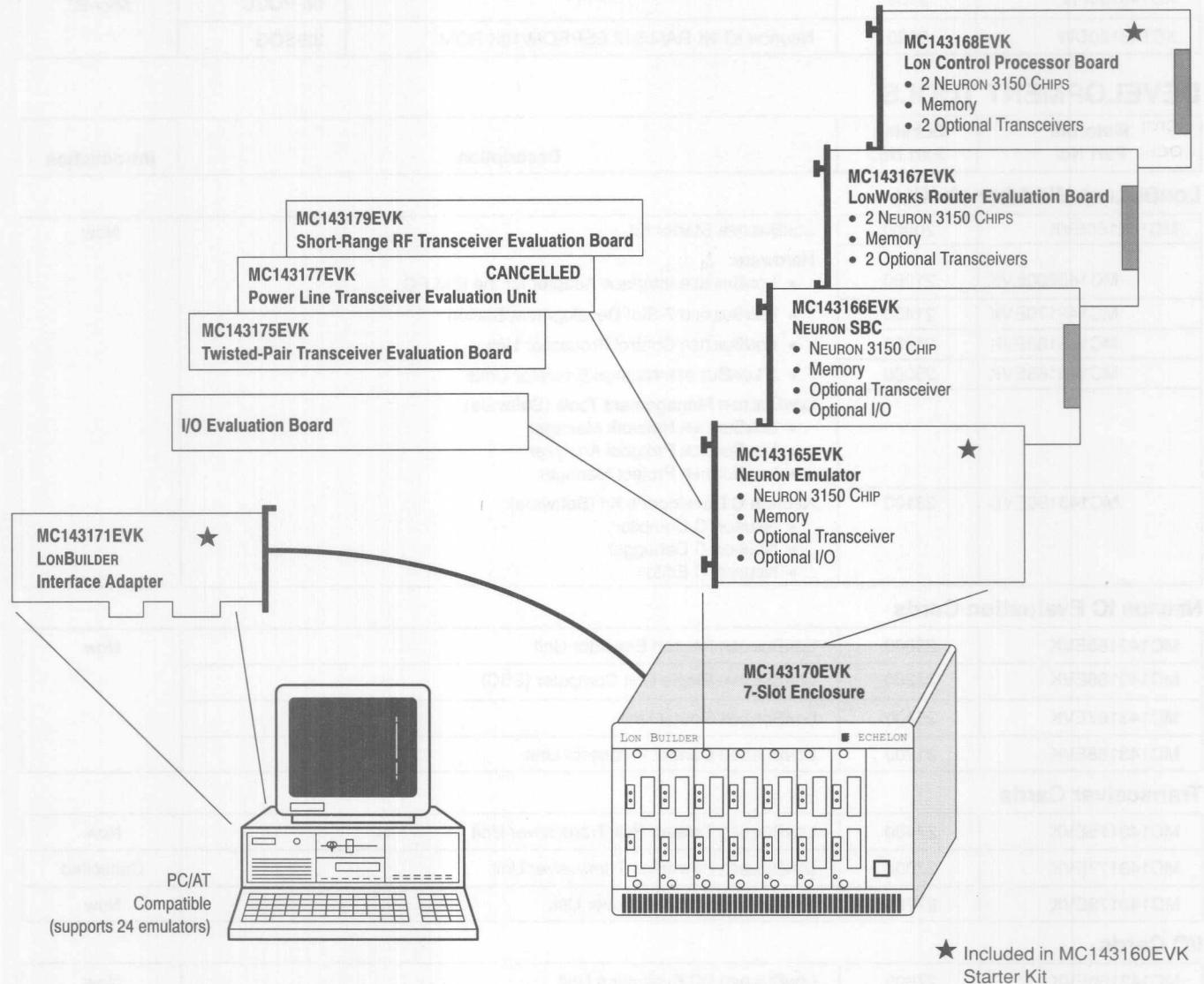


# LONBUILDER Developer's Workbench

The LONBUILDER Developer's Workbench is an integrated hardware and software environment that provides the tools necessary to build intelligent distributed control networks quickly, easily, and inexpensively.

The LONBUILDER Developer's Workbench consists of hardware to configure nodes with various options of media

interconnectivity and I/O interface for development of prototypes. A family of hardware and software products are available to enable customers to configure and build intelligent distributed control products.



## LONBUILDER Starter Kit (MC143160EVK)

The LONBUILDER Starter Kit contains all the tools necessary to begin LonWORKS development on a PC/AT or compatible computer. The starter kit contains a LONBUILDER Development Station (7-slot enclosure and PC interface adapter board) and the Interactive Development Environment Software consisting of the Network Management Tools and the NEURON C Developer's Kit. The starter kit also contains two LONBUILDER NEURON CHIP Emulators. The backplane built into the enclosure can be used as an internal development network, or optional LONBUILDER transceiver evaluation boards are available for external powerline, radio frequency, and twisted pair networks.

LONBUILDER requires an IBM PC/AT compatible computer with one available 8- or 16-bit slot, EGA or VGA compatible graphics adaptor, 640 KB RAM, 1.5 MB extended or LIM 4.0 expanded memory, MS-DOS or PC-DOS version 3.3, 4.0 or 5.0, a Microsoft-compatible mouse, and a hard disk with 10 MB of available space. LONBUILDER software is distributed on 1.2 MB 5-1/4" and 720 KB 3-1/2" diskettes. The development station requires the same hardware as the Starter Kit. The NEURON C Developer's Kit and NEURON CHIP emulators are required for developing NEURON C applications.

Motorola Part No.	Echelon Part No.	Description	Leads-Package	Introduction
XC143150FU	3150	NEURON IC 2K RAM/512 EEPROM	64-QFP	Now
XC143150FN	3150		68-PQCC	May-92
XC143120DW	3120	NEURON IC 1K RAM/512 EEPROM/10K ROM	32-SOG	

## DEVELOPMENT TOOLS

Motorola Part No.	Echelon Part No.	Description	Introduction
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### LONBUILDER Workbench Kits

MC143160EVK	20000	LONBUILDER Starter Kit  Hardware: <ul style="list-style-type: none"><li>• LONBUILDER Interface Adaptor for the IBM PC</li><li>• LONBUILDER 7-Slot Development Station</li><li>• LONBUILDER Control Processor Unit</li><li>• 2 LONBUILDER NEURON Emulator Units</li></ul> LONBUILDER Management Tools (Software): <ul style="list-style-type: none"><li>• LONBUILDER Network Manager</li><li>• LONBUILDER Protocol Analyzer</li><li>• LONBUILDER Project Manager</li></ul> NEURON C Developer's Kit (Software): <ul style="list-style-type: none"><li>• NEURON C Compiler</li><li>• NEURON C Debugger</li><li>• NEURON C Editor</li></ul>	Now
MC143200EVK	21000		
MC143170EVK	21400		
MC143168EVK	21200		
MC143165EVK	25000		
MC143190EVS	23100		

### NEURON IC Evaluation Cards

MC143165EVK	25000	LONBUILDER Neuron Emulator Unit	Now
MC143166EVK	25200	LONBUILDER Single Unit Computer (SBC)	
MC143167EVK	25400	LONBUILDER Router Unit	
MC143168EVK	21200	LONBUILDER Control Processor Unit	

### Transceiver Cards

MC143175EVK	27400	LONBUILDER Twisted Pair Transceiver Unit	Now
MC143177EVK	27000	LONBUILDER Powerline Transceiver Unit	Cancelled
MC143179EVK	27200	LONBUILDER RF Transceiver Unit	Now

### I/O Cards

MC143180EVK	27800	LONBUILDER I/O Evaluation Unit	Now
MC143182EVK	28000	LONBUILDER I/O Demo Multifunction Kit	

### Accessories

MC143170EVK	21400	LONBUILDER 7-Slot Development Station	Now
MC143172EVK	21600	LONBUILDER Extender Card	
MC143173EVK	21410	LONBUILDER SBC Enclosure	
MC143200EVK	21000	LONBUILDER Interface Adapter Card	
MC143201EVK	21300	LONBUILDER Interface Adapter Cable	

### Software

MC143190EVS	23100	"NEURON" "C" Developer's Software Kit	Now
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Document Number	Number	Description	Available
<b>Data Sheets</b>			
MC143150/D		MC143150/20 NEURON IC Data Sheet	Apr-92
MC143XXXEVK/D		MC143XXX LONBUILDER Data Sheet	Now
LONKITSUM/D	003-0001-01	MC143160EVK LONBUILDER Starter Tools	
LONBDSUM/D	003-0003-01	MC143165/66/67EVK LONBUILDER Processor Boards Summary	
LONTP/D	003-0004-01	MC143175 LONBUILDER Twisted Pair Transceiver	

### Selector Guides

SG170/D		LonWORKS Product Selector Guide	Mar-92
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### Brochures

BR1120/D		LONBUILDER Brochure	Apr-92
BR1107/D		LonWORKS Applications Primer	Now
BR1108/D		LonWORKS Product Line Brief	

### Manuals

NEURONCPG/AD	078-0002-01A	NEURON "C" Programming Guide	Apr-92
LONUG/AD	078-0001-01A	LonWORKS Users Guide	

### Application Notes

EB146/D	005-0003-01	NEURON Chip Quadrature Input Function Interface	Now
EB147/D	005-0006-01	LonWORKS Installation Overview	
EB148/D	005-0001-01	Enhanced Media Access with LONTALK Protocol	
EB149/D	005-0011-01	Optimizing LONTALK Response Time	
EB150/D	005-0009-01	NEURON CHIP RS-485 Transceiver	
EB151/D	005-0004-01	Scanning a Keyboard with a NEURON CHIP	
EB152/D	005-0002-01	How to Use SNVTs in LonWORKS Applications	
EB153/D	005-0014-01	Driving a Seven Segment Display with the NEURON CHIP	

Motorola has LONBUILDER Development tools in many of its sales offices around North America. For more information or a demonstration of the Motorola LONBUILDER Development tools, contact the nearest Motorola Technical Sales Engineer, as listed on the following table.

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# North American LonBUILDER Demo Support Centers

Office Locations	Phone Number	Demo Centers	Technical Sales Engineers
ALABAMA, Huntsville ARIZONA, Phoenix ARIZONA, Phoenix	205-830-1051 602-897-5077 602-897-5093	yes	Jim Chandler Don Aldridge Tony Kouvousis
CALIFORNIA, Agoura Hills CALIFORNIA, Agoura Hills CALIFORNIA, Agoura Hills CALIFORNIA, Irvine CALIFORNIA, Sacramento CALIFORNIA, San Diego CALIFORNIA, San Diego CALIFORNIA, Sunnyvale CALIFORNIA, Sunnyvale CALIFORNIA, Sunnyvale	818-706-1929 818-706-1929 818-706-1929 714-753-7360 916-922-7152 619-541-2191 619-541-2176 408-991-7383 408-749-0510 408-991-7341	yes yes yes	Mark Torpeh Bill Caruso Ray Moshiri Al Jackson Jim Kenny Francis Christian Jon Creighton Al Chame Laura Flemming Don Bloxsom
CANADA, Toronto COLORADO, Denver COLORADO, Denver CONNECTICUT, Wallingford	416-756-5258 303-337-3434 303-337-3434 203-284-0810	yes yes	Derrick Klotz Dan Byers Zwi Rosenstein Steve Reinhardt
FLORIDA, Orlando FLORIDA, St. Petersburg FLORIDA, Maitland GEORGIA, Atlanta GEORGIA, Atlanta	305-486-9776 813-576-6035 407-628-2636 404-449-3875 404-449-3875	yes yes	Brent Phagen (See Orlando, Florida) (See Orlando, Florida) Paul Doherty Kim Taylor
ILLINOIS, Chicago ILLINOIS, Chicago INDIANA, Fort Wayne INDIANA, Indianapolis IOWA, Cedar Rapids KANSAS, Kansas City	708-884-2504 708-884-2560 219-436-5818 317-571-0400 319-373-1328 913-451-8555	yes	Ray Begitschke Tony Borkowski (See St. Louis, Missouri) (See St. Louis, Missouri) (See Chicago, Illinois) Rick Heady
MARYLAND, Columbia MASSACHUSETTS, Woburn MASSACHUSETTS, Woburn MASSACHUSETTS, Woburn	301-381-1570 617-932-6051 617-932-6038 617-932-6043	yes yes	Bob Boyer Richard Lewis Will Dawson Steve Shoap
MICHIGAN, Detroit MINNESOTA, Minneapolis MINNESOTA, Minneapolis MISSOURI, St. Louis	313-347-6800 612-941-6800 612-941-6800 314-275-7380	yes yes	(See Cleveland, Ohio) Jim Gray Jay Farnum Khalid Shah
NEW YORK, Hauppauge NEW YORK, Poughkeepsie NEW YORK, Rochester NORTH CAROLINA, Raleigh	516-361-7000 914-473-8102 716-425-4000 919-870-6026	yes yes yes	Vic Minichiello (See Hauppauge, New York) Gary Kloesz Mark Terry
OHIO, Cleveland OHIO, Columbus OHIO, Dayton OKLAHOMA, Tulsa OREGON, Portland PENNSYLVANIA, Philadelphia TENNESSEE, Knoxville	216-349-3100 614-431-8492 513-495-6800 918-252-5734 503-641-3681 215-957-4100 615-690-5593	yes yes	Jim Brosnahan (See Cleveland, Ohio) Gordon Doughman (See Richardson, Texas) Jim Carlson John Davis (See Atlanta, Georgia)
TEXAS, Austin office TEXAS, Austin factory TEXAS, Austin factory TEXAS, Houston TEXAS, Richardson TEXAS, Richardson	512-873-2000 512-928-5001 512-928-5458 713-251-1291 214-480-5611 214-480-5612	yes yes yes	Paul Ardi Jeff Koonce Don Simon (See Austin, Texas) Dave Lapham Gus Larson
VIRGINIA, Richmond WASHINGTON, Seattle WISCONSIN, Milwaukee	804-285-2100 206-454-4160 414-792-0122		Bill Lucas Dave Hyder Dave Wilson

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ASIA PACIFIC: Motorola Semiconductors H.K. Ltd.: Silicon Harbour Center. No. 2 Dai Kina Street. Tai Po Industrial Estate.



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